Orchard Street Ravine

Pedestrian Trail Connection

Feasibility Study

DRAFT

July 12, 2006

prepared by
SvR Design Company

for
Seattle Parks and Recreation

SvR DESIGN COMPANY

Orchard Street Ravine
Pedestrian Trail Connection Feasibility Study

Background and Context

Background

The Orchard Street Ravine (ravine) is located in West Seattle at 7200 38th Avenue SW at the unimproved intersection of SW Orchard Street and 38th Avenue SW (see Exhibits 1 and 2 for site context). Preservation of the ravine was initiated in 1989 by the local community in an effort to maintain the site as a natural area. The project includes the unimproved right-of-way and 1.6 acres of adjacent land that was acquired by the City of Seattle in 1996. Improvements are being funded through the Pro-Parks Levy. Many community groups have been involved in the planning of this open space including the Morgan Junction Community Association (MoCA), Orchard Community Association (ORCA), and the Friends of Orchard Street Ravine (FOStR). The site is part of the "Green Crescent", an initiative to link green spaces through the Morgan Junction neighborhood, including Solstice Park and Myrtle Reservoir. The site, located at the terminus of three street ends, is under the jurisdiction of Seattle Parks Department and Seattle Department of Transportation (see Exhibit 3 for the Ravine Study Area Map). Current projects under design include a loop trail at the bottom of the ravine and a vegetation management plan for the entire ravine. For further background information, see "Resources" at the end of this report.

Context

The ravine is located in West Seattle, west of 35th Avenue SW, a primary arterial. It is located to the southwest of the water tower at Myrtle Reservoir at the highest elevation in Seattle. The Morgan Junction neighborhood is primarily residential. Small commercial areas are located several blocks to the north, east, and west of the site. The High Point neighborhood, currently under redevelopment, is located northeast of the ravine, across 35th Ave SW.

High Point Elementary School and Community Center are approximately four blocks northeast of the ravine. Gatewood Elementary School is approximately five blocks northwest. Hughes School and Playground are approximately eight blocks southeast. Lincoln Park is located downhill to the west approximately six blocks. Solstice Park is located approximately five blocks to the southwest.

Study Goals

During the Seattle Parks Department's planning process, the neighborhood identified a goal to establish a pedestrian connection between the community at the top of the ravine and the proposed lower loop trail in the ravine area. Two street ends, SW Orchard Street and 38th Avenue SW, have been identified as potential access points. The goals of this feasibility study are to study access from both street ends and the potential implications of this access on the slope. Aspects of this study include:

- Review of potential ADA access.
- Identification of environmental and development code requirements.
- Development of trail options from each street end and approaches to construction.
- Estimated construction budget costs and project management costs.

ADA Access

Trail accessibility was examined based upon Washington State Standards for Accessible Routes. Due to the steep and rugged nature and the ravine program description SvR determined that the paths fall into the "hiking trails" classification. The ADA review was the first analysis done in order to establish basic criteria for the program. The criteria for trail construction include the following:

- Surface – firm and stable.
- Maximum Running Slope – 1:20 (for any distance), 1:12 (for maximum 200 ft.), 1:10 (for maximum 30 ft), 1:8 (for maximum 10 ft).
- Maximum Cross Slope – 1:20 (exception 1:10 at the bottom of an open drain where clear tread is a minimum).
- Minimum Clear Tread Width – 36 inches for any distance.
- Edge Protection – Not required; but where provided, 3 inch minimum.
- Tread Obstacles – 2 inch high maximum.
- Passing – Every 1,000 feet where clear tread width is less than 60 inches, a 60 x 60 inch passing space or a T-shaped intersection of two walking surfaces with arms and stem extending a minimum of 48 inches.
- Resting Intervals – 60 inches minimum length, width at least as wide as the widest portion of the trail segment leading to the resting interval and a maximum slope of 1:20.
- Openings - .Openings should not permit a sphere greater than ½ inch diameter to pass thru gap or grating. Elongated opening should be placed so that long dimension is perpendicular or diagonal to the path of travel.

- Protruding Objects – 80 inch minimum clear head room. If unavoidable, object should not extend greater than 4 inches into the travel space.
- Handrails – not required.

From the street end of SW Orchard Street the grade change to the loop trail is approximately 64 feet. From the street end of 38th Avenue SW the grade change to the loop trail is approximately 36 feet. Exhibits 4 and 5 illustrate the lineal footage of trail required to provide a 1:20 /5% trail access from the loop trail up to each street end. In the case of SW Orchard Street, the accessible trail would need to be 1,135 feet long. In the case of 38th Avenue SW, the trail would need to be approximately 555 feet long. The level of grading and wall construction required for both trails would have a major impact on the ravine's critical slopes (see "Environmentally Critical Areas and Development Code Requirements" below). This situation appears to allow a condition for departure from compliance with Washington State accessibility guidelines. For this reason, the two options explored below are not ADA accessible. The viewing platforms at the top of the ravine and landings at the bottom can be made accessible and signage can be provided to direct the mobility impaired to the lower loop. A detailed survey is needed at the proposed platform overlook areas in order to be able to create a detailed ADA accessible design.

Environmentally Critical Areas (ECAs) and Development Code Requirements

The ravine is classified as a "landslide-prone hazard area" and some sections within the ravine are classified as a steep slope area under the city's Environmentally Critical Areas (ECA) ordinance (see Exhibit 6). The City of Seattle updated the ECA regulations on May 9, 2006. These recent updates revised the criteria for exemptions within ECAs.

Seattle Municipal Code (SMC) Section 25.09.045(H)(1) and (H)(3)(f) states that if a project is a public and benefits the community, it could be located on a steep slope or associated buffer provided the following:

- The project must have a vegetation management plan which must be approved by a geotechnical engineer if the steep slope is in a landslide prone area.
- A trail must be designed and located to minimize disturbance to the slope.

In order to permit and design the trail in coordination with the vegetation management plan, the following regulations of the SMC will apply:

- The vegetation management plan must be approved by a geotechnical engineer since the steep slopes adjacent to the project area are in a landslide prone area.

- Complete stabilization of all portions of the site disturbed or affected by the proposed development.
- Seattle Department of Planning and Development (DPD) may require a third party review, paid by the applicant, but hired by the Director, of the geotechnical supporting documents.

The extent of the required testing, investigation, calculations, report and pre and post construction monitoring is to be determined in coordination with the DPD's Geotechnical Reviewer as the project moves through the permit process. The final design may require field documenting of actual ECA slope conditions.

Design and Construction

The slopes on the project site range between 5% and 50%, with some scarp areas with short vertical sections. In order to provide a pedestrian connection through the ravine, slopes over 40% cannot be avoided. The proposed trail alignment and recommended construction methods will minimize the area of slope disturbance. The proposed path designs set forth in this report avoid long sweeping trails across the ravine in order to minimize terracing, as well as to minimize impacts on natural drainage courses and slopes. Construction will occur with small motorized equipment or by hand where needed.

In previous public meetings and in correspondence between the Seattle Parks Department and State Fish and Wildlife personnel, the need to minimize the "social trail" development has been identified, since informal trails produced by foot traffic are not desirable from a wildlife habitat, vegetation management or slope stability standpoint. Establishing an organized trail network benefits the public and the environment.

Based on our review of city and state codes related to the proposed project, it appears that pedestrian connections, which use a series of gravel trails, with and without steps, and with appropriate foundations, are not expressly prohibited by the codes. There will need to be a detailed review of the design and site-specific conditions by a geotechnical engineer, including potential field work and supporting calculations, to allow the construction to occur.

Drainage

The ravine area is located down slope of 38th Avenue SW and SW Orchard Street. The ravine is near the topographic highest point of Seattle and has a southwesterly exposure. Existing site conditions are heavily vegetated slopes with medium to thick understory and a number of large second-growth trees.

According to City of Seattle's GIS information, no public storm drainage facilities exist in the project area. There is a sanitary sewer mainline located at the bottom of the ravine at the intersection of 38th Avenue SW and SW Orchard Street, approximately 150 feet from the project site.

SvR conducted a field visit and a review of previous documents that include the geotechnical report, prepared by Shannon and Wilson, dated February 22, 2006 and the Geotechnical Evaluation Memorandum, prepared by Mark Orth with the City of Seattle, dated January 24, 2006. SvR observed the site and the surrounding topography and found that portions of 38th Avenue SW and SW Orchard Street rights-of-way drain towards the project site. Surface drainage from surrounding residences also drains towards the site, including a wall drain from 3618 SW Orchard Street (Note: The wall drain was not verified in the field, drain location assumed from standard wall construction components).

Based on GIS topography, one major natural drainage course bisects the project site, running from the southwest corner of 3618 SW Orchard Street to the termination of 38th Avenue SW at the proposed project site parking area. Both trail concepts studied avoid this drainage course, however, the lower trails intersect some minor drainage courses below the ECA buffer areas (see Exhibit 7). Where the trails intersect the minor drainage courses by traversing the slope, localized drainage can be passed under the trail and distributed to the surrounding forest.

SvR reviewed the existing street end drainage in the field and believes that the best approach is to allow surface drainage to continue on its current, mainly unconcentrated course as there does not appear to be major erosion occurring under normal conditions. The drainage strategy will need to be reviewed further in conjunction with the revegetation process if temporary or permanent drainage management is needed either in pipes or surface reinforcement for surface flows. Any small retaining walls along the paths will have free draining backfill and walls over 2 feet in height will have perforated wall drains that will be conveyed under the trail and dispersed with a flow spreader. Concentration of flows would be minimized where the trail intersects a drain path by traversing the slope.

Drainage Summary
SvR recommends the drainage be evaluated for necessary conveyance improvements as the project progresses and the preferred trail concept is selected. Based on available information, the current city code indicates that no detention or water quality treatment will be required for this project. Natural drainage courses will be maintained.

Development of Trail Options

Following a review of technical requirements, the recommended design approach for a pedestrian connection is to minimize long traversing paths in the steeper sections. This approach will minimize disturbance to the steeper areas, minimize interception and concentration of natural drainage, and allow larger patches of urban forest to remain free from human intrusion.

In the study of concepts for the SW Orchard Street connection several approaches were examined including a simple switch-back path, with gradients ranging between 5 to 15%. Based upon preliminary study this approach would have a significant impact on the slope, requiring walls and drainage accommodations. Additionally, the informal gravel path requires more maintenance on a regular basis. The informal path approach was not carried forward because of the degree of impact and long-term maintenance. SvR reviewed connections with paths and stairs in lieu of this approach.

SvR reviewed two potential pedestrian connections through the Orchard Street Ravine in this feasibility report, Concept A from SW Orchard Street and Concept B from SW 38th Avenue. Both options adjoin the lower loop trail. See Exhibit 8 for the layout and orientation of the two trail concepts and Exhibits 9 and 10 for detailed layouts.

Concept A
Trail Concept A (see Exhibit 9) provides a connection from the SW Orchard Street end to the lower loop trail. This trail is a combination of structural stairways constructed of lumber treads on lumber or metal stringers with pin pile supports; on-grade tie and gravel treads with a 6 inch rise and 18 inch run; and gravel paths between the stairways. Construction of the structural stairways will minimize grading on the slopes. Construction of the paths between stairways will require some walls and grading. Stairways will have metal and wood railings on both sides. Handrails have been included on one side of the timber steps.

A lumber deck at the top of the trail provides a viewing area to the west. Access to the street end is along an existing gravel drive from 36th Avenue SW. This access could be upgraded with an improved gravel path along the edge of the road, creating

a more formal or noticeable pedestrian route. The lower end of the trail is connected to the loop trail with a gravel path.

Concept B
Trail Concept B (see Exhibit 10) provides a connection from the 38th Avenue SW street end. This trail is a combination of a 6 inch rise and 12 inch run on-grade tie and gravel treads, and wider 6 inch rise and 24 inch run treads. The path crosses the existing gravel drive. This crossing may require signage. Stair construction in some areas will require a method of retaining one or both sides of the trail and grading. As in the case of Concept A, handrails have been included on one side of the timber steps.

A lumber deck at the top of the trail provides a viewing area. The lower end of the trail is connected to the loop trail with short gravel path.

Approach to Construction and Materials

The development of the trails on the steep slopes will require a combination of details that are appropriate for each condition. Exhibits 11 and 12 illustrate sections through these various conditions and include timber steps and gravel paths, with and without walls; and stairs on stringers.

The selection of construction materials will need further study as the project moves into design. The pros and cons associated with various materials include:

Trail Walls
Trail walls may be rockery, timber, mechanically stabilized earth or a combination of all. Overall, rockeries would be the most economical approach, depending upon the height and location of the walls. Materials for low walls made of one man rocks could be wheelbarrow into the site. Timber walls or Mechanically Stabilized Earth (MSE) may be more appropriate for mid-slope walls that are less accessible.

Timber Steps
Timber steps would be detailed per the Seattle Parks Department standard details. The treads of timber steps can either be treated 6 x 6 or plastic 6 x 6. The cost, longevity, appropriate use and slip resistance of each option need to be further explored with the Seattle Parks Department designers and maintenance staff. The cost benefit of using recycled timbers and materials will need to be reviewed.

Handrails
Stair handrails currently included are metal pipe rail posts and wood handrails to match the Seattle Parks Department design proposed for the lower loop trail.

Stair Treads on Stringers
Stair Treads on stringers are costed in this study as treated wood. As noted above, the cost, longevity, appropriate use and slip resistance of treated vs. plastic lumber will need to be further explored with the Seattle Parks Department designers and maintenance staff.

The two materials reviewed for stringers were metal and wood. Galvanized metal was viewed as a potential option to provide a longer term product than wood and still can be carried in by hand. A discussion will need to occur between the designers and maintenance staff to create an approach which meets the budget, aesthetics, functionality and maintenance goals.

Stair Foundation Supports
The stair foundations proposed are pin pile foundations. The pin piles would be installed using a hand held gas driven ram to install the pin piles. The piles would minimize the disturbance to the slope and pass through the organic or loose soils on the surface to become imbedded in the stronger underlying soil structure. Field investigation along the alignment would indicate the depth and final design of the piles.

Another benefit of the pin piles is that if there is movement in the stair, new piles can be placed and reattached to the stairway or the old attachment to the pin pile can be disconnected and the stair can be jacked into place and reattached.

Signage
The level of signage can vary depending on needs and budget. At a minimum we would recommend providing directional signage at the upper trail areas to notify pedestrians and users that the stairs and path are not accessible and how they would get to the lower loop trail. Both City of Seattle rights-of-way are unimproved dead ends and therefore pedestrian vehicular conflicts would be minimal. The signage could include informational displays at the landings to describe the history of the ravine, the efforts for revegetation and even a larger map of the area showing connections to Lincoln Park, the new reservoir park and High Point Community Center etc. The signage should tie into the character of other West Seattle area wayfinding.

Summary

There are two potential pedestrian connections through the Orchard Street Ravine reviewed by this feasibility report, from SW Orchard Street (Concept A) and from

SW 38th Avenue (Concept B) to the new lower loop trail. Both options are technically feasible. Based on our review the access to SW 38th Avenue would be constructed with methods similar to the lower loop and any larger excavation or installation of retaining features can be accessed from the driveway in the SW 38th Avenue right-of-way. The connection to street end of SW Orchard Street would involve more of a structured solution in the steeper upper areas. This would require soils investigations and structural design to determine depth to bearing soil and to determine scope of foundation installation for stairways. This has been included on the budget level cost estimates. SvR does recommend that any decisions for materials, alignments and cost take into consideration long term maintenance.

Concept A- SW Orchard Street Access

Pros

- Access from SW 36th Street and reservoir to street end could be ADA accessible.
- Views of Sound from street end.
- Stairs on stringers minimize impact to slope.

Cons

- Gravel path connections between stairs will require small walls.
- Soils investigation and structural design for stairway and wall construction will be necessary.
- SW Orchard Street connection is longer than 38th Avenue SW because of additional 30 vertical feet in elevation.
- Access for maintenance and repair more difficult. Maintenance costs will depend upon final materials specified.
- Construction cost greater because of increased length of trail and structural requirements.

Concept B - 38th Avenue SW Street Access

Pros

- Good access to much of the site construction from existing driveway and loop trail.
- Views of Sound from street end.
- Vertical elevation change 30 feet less than Concept B.
- Timber stair construction similar to loop trail, and maintenance.
- Construction costs less than that Of Concept A.

Cons

- Access along SW 38th Avenue is not ADA accessible and would be difficult to achieve.
- Soils investigation and wall construction will be necessary.

- Path system crosses narrow existing driveway.
- Timber stairs will require some wall construction.
- Design will impact area between street end and driveway not currently included in vegetation plan.

Based upon these pros and cons, Concept B would cause the least impact and be the most cost effective (maintenance and construction) of the two options.

Resources

Birkby, Robert, Student Conservation Association, Lightly on the Land, The SCA trail-building and maintenance Manual, The Mountaineers, 1996

Fischer, Marcia, Orchard Street Ravine Vegetation Management Plan (Draft), Natural Systems Design, June, 2006.

Demrow, Carl and Salisbury, David, The Complete Guide to Trail Building and Maintenance, Appalacian Mountain Club Books, Boston MA, 1998

Morgan Junction Neighborhood Plan, January 19, 1999

Orth, Mark, "Memorandum: Geo-technical Evaluation of Orchard Street Ravine Through-Trail Options", Seattle Parks and Recreation, January 24th, 2006.

Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas Final Report September 30, 1999

Thompson, Patricia, "Memorandum", Washington Dept. of Fish and Wildlife, December 12, 2005.

"What is an Accessible Trail?", Access Today, Fall 2002, Special Volume, Issue 8.

www.access-board.gov/outdoor/outdoor-rec-rpt.htm ; Designing Sidewalks and Trails for Access; Part II of II: Best Practices Design Guide)

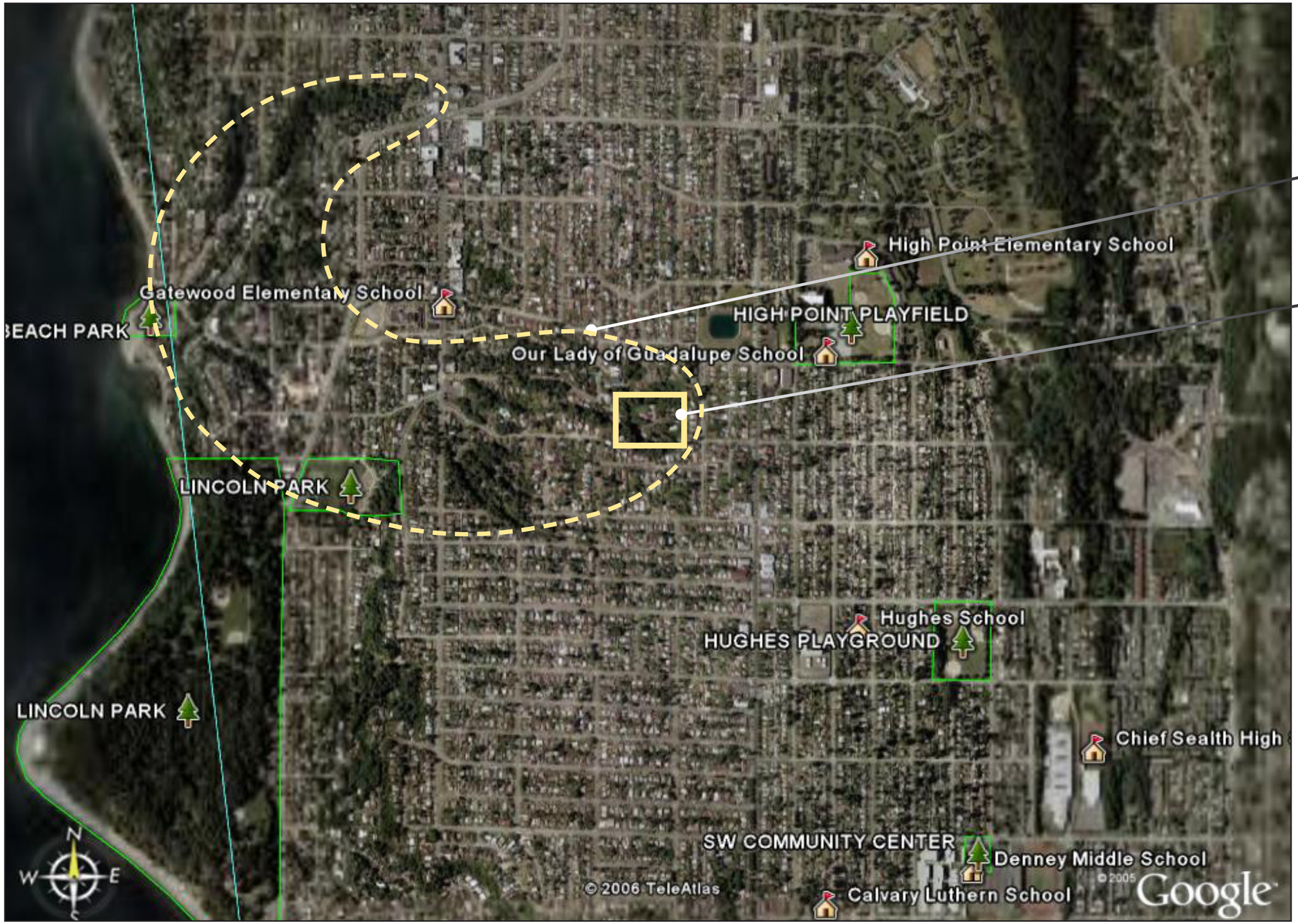
www.fhwa.dot.gov/environment/sidewalk2/index.htm, International Building Code)

www.friendsoforchardstreetRavine.org

www.orcaseattle.org

www.morganjunction.org

www.ci.seattle.wa.us/parks/proparks/projects/orchardStRavine.htm



July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

Exhibit 1

Feasibility Study

Site Context

July 10, 2006

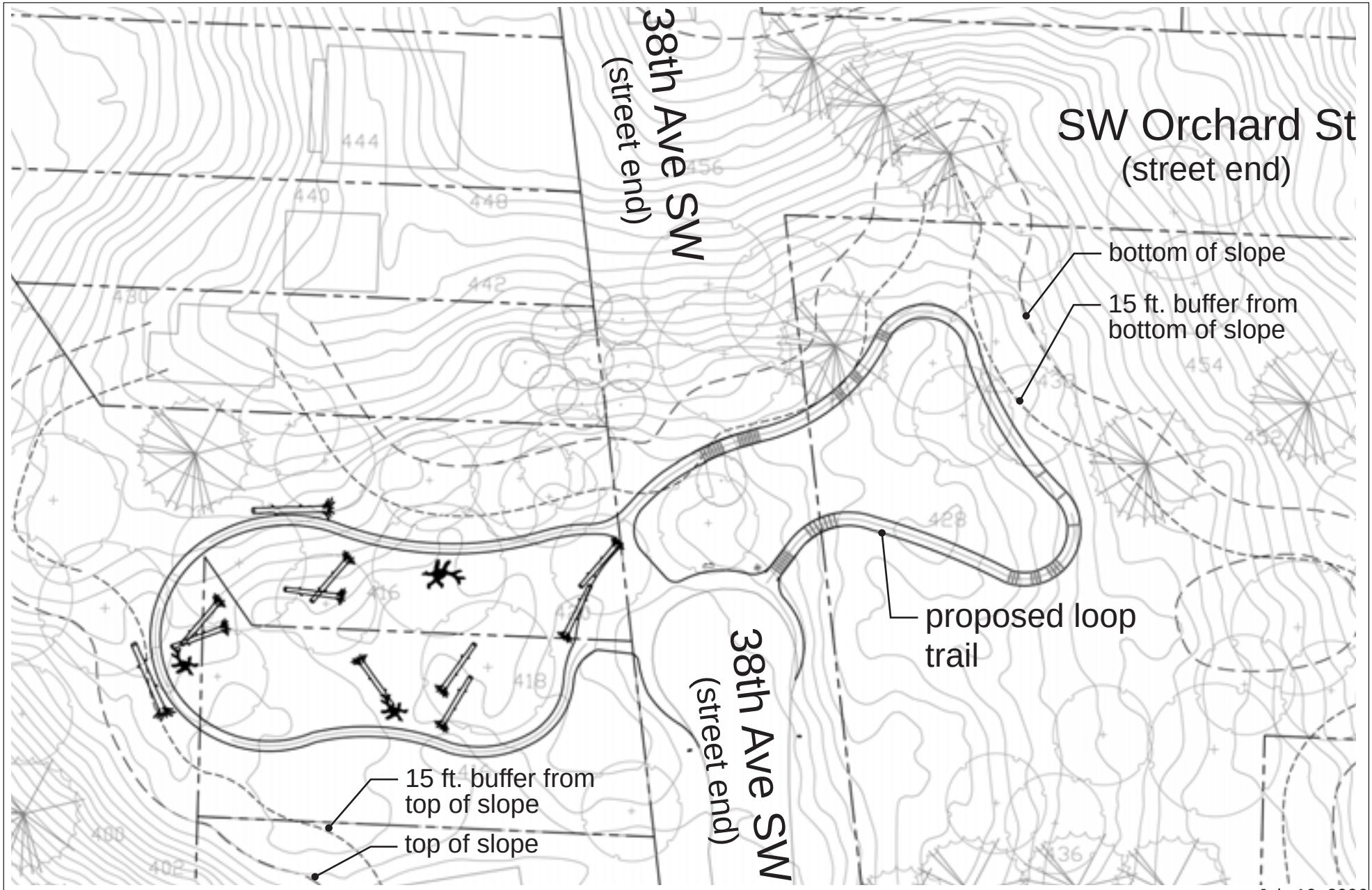
SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

Exhibit 2

Feasibility Study

Site Context



July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

Exhibit 3

Feasibility Study

Ravine Study Area Map

0 40

Scale

N

July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

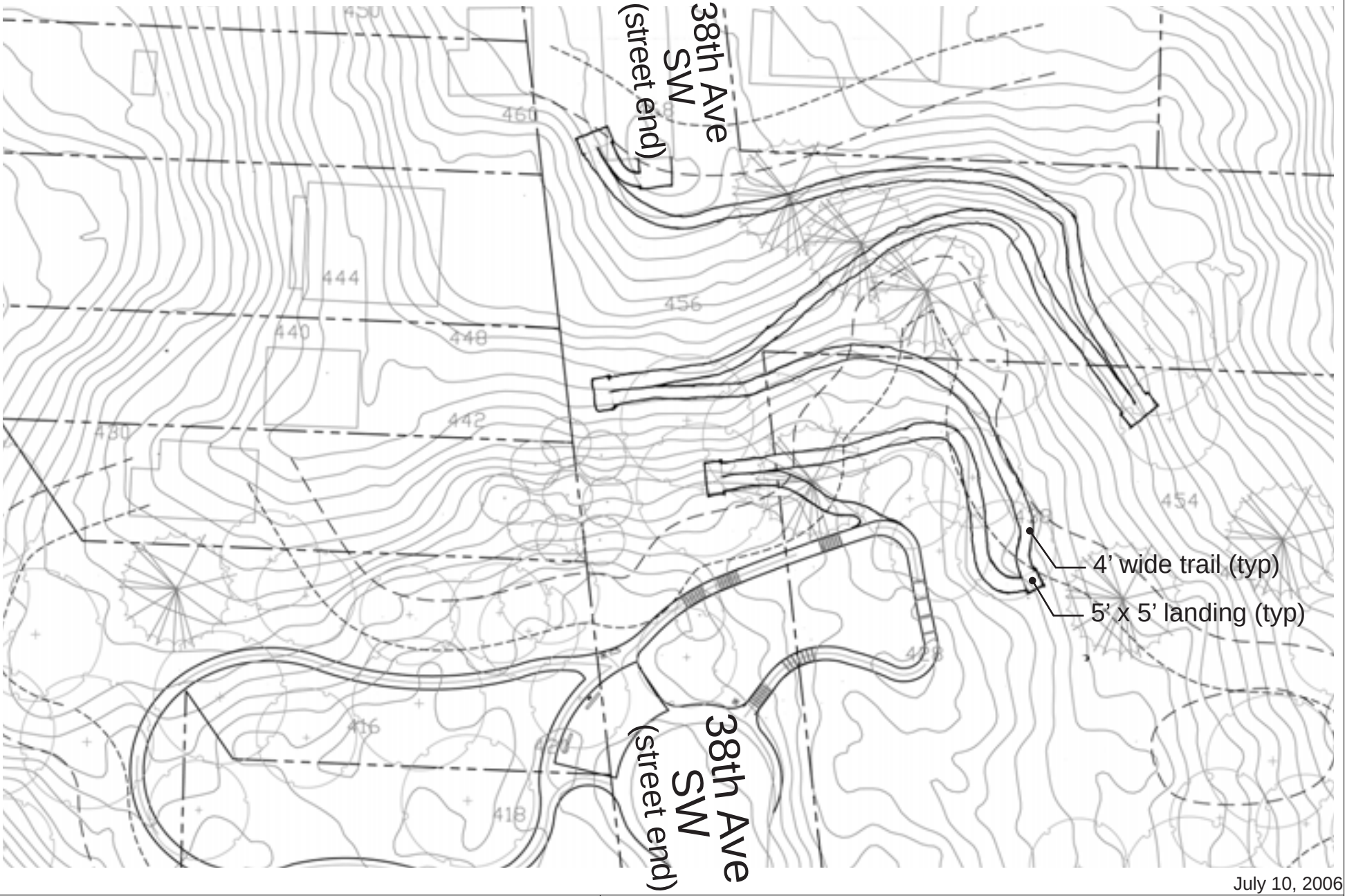
Exhibit 4

Feasibility Study

SW Orchard St - 5% Slope Trail Study

0 40
Scale

N



July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

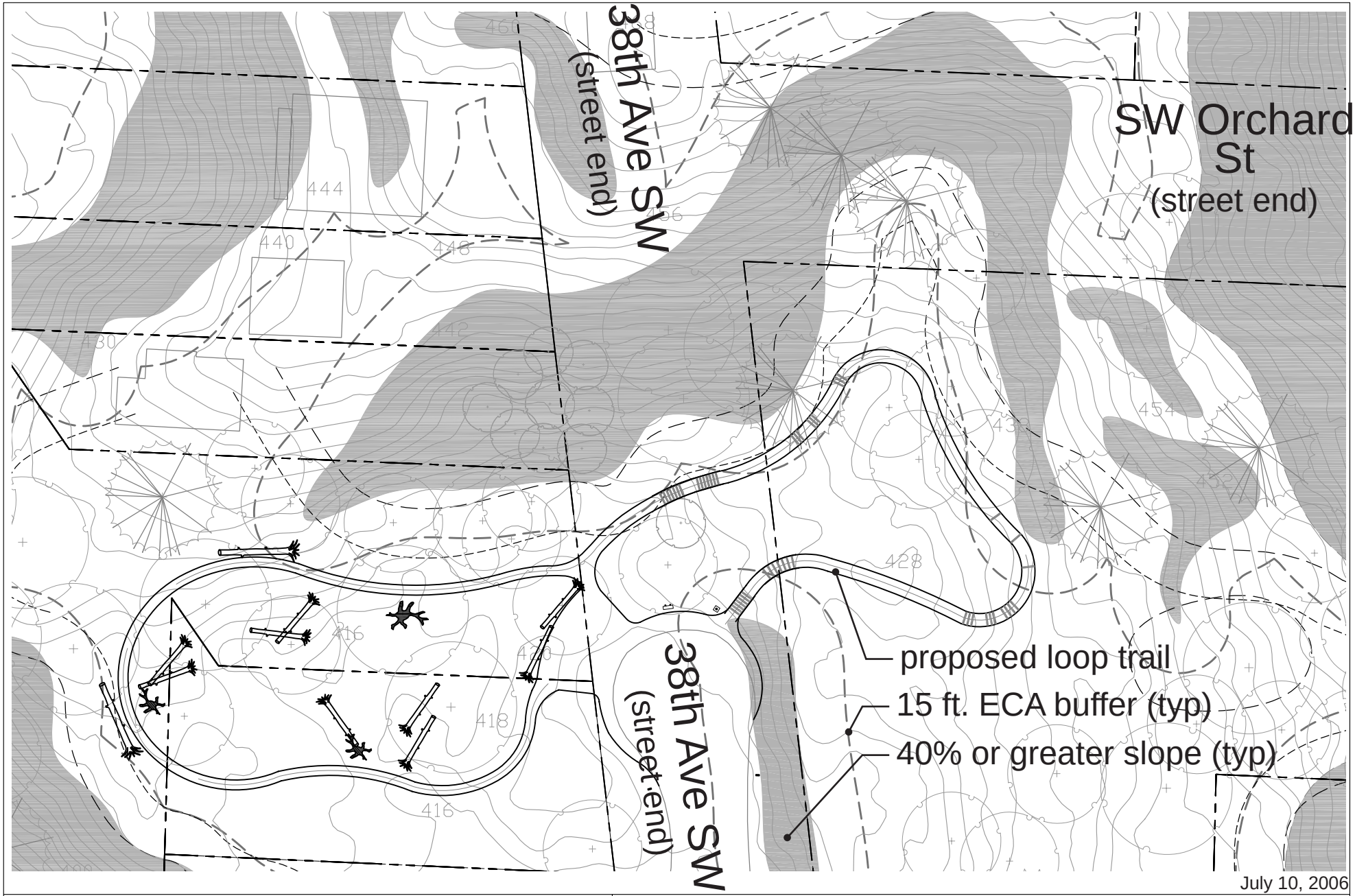
Exhibit 5

Feasibility Study

38th Ave SW - 5% Slope Trail Study

0 40
Scale

N



July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

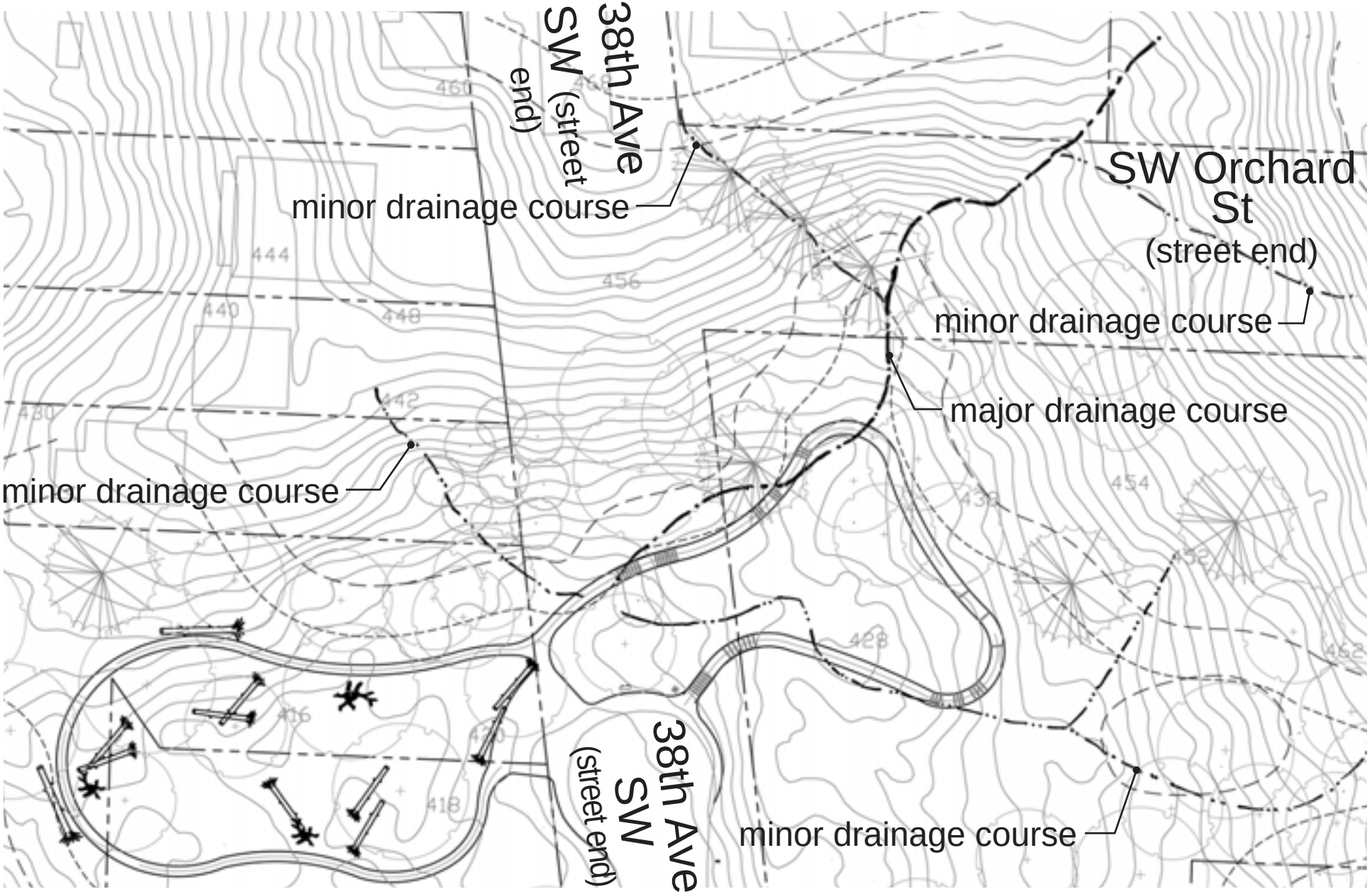
Exhibit 6

Feasibility Study

ECA Map

0 40
Scale

N



major and minor drainage courses are designations for the purposes of this report only.

July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

Exhibit 7

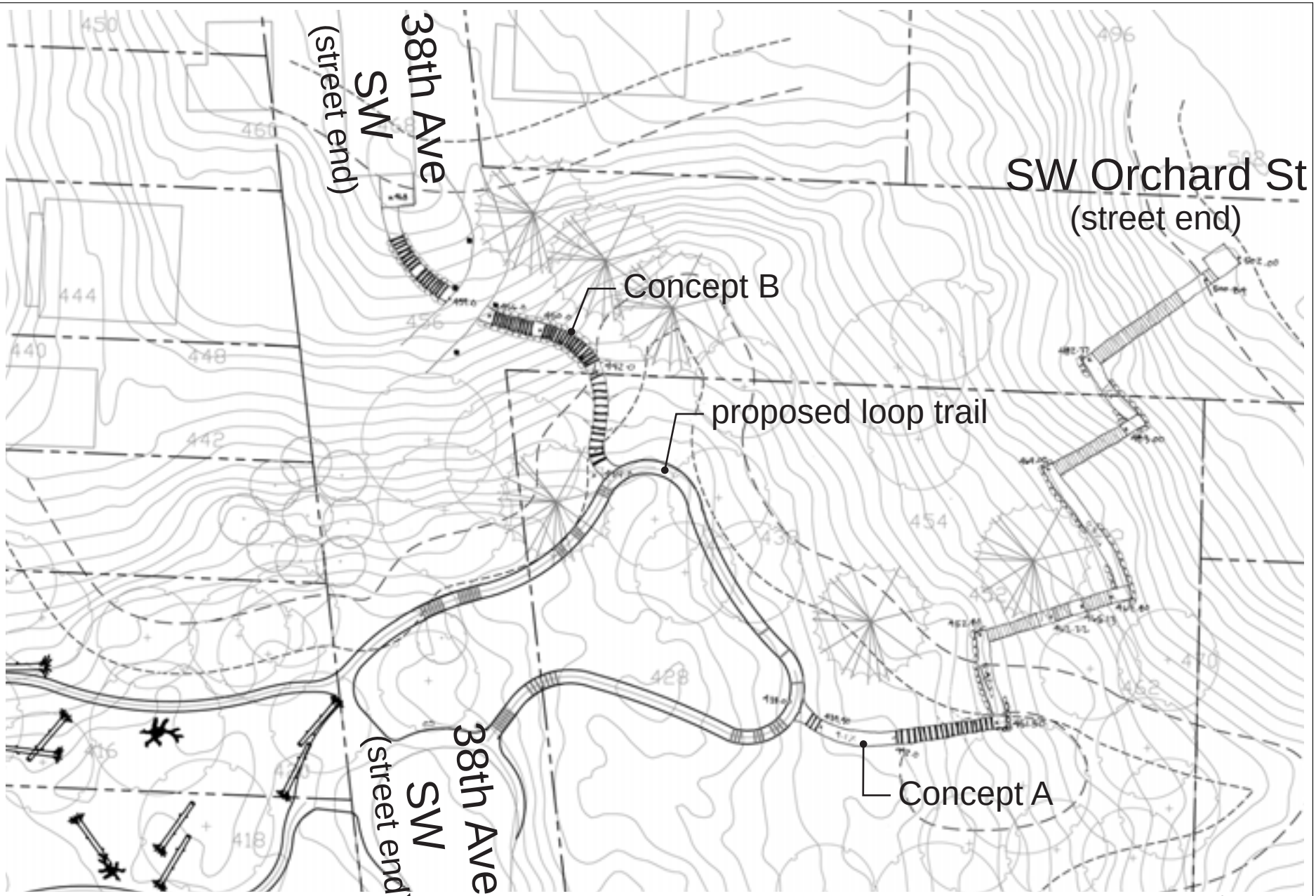
Feasibility Study

Drainage Map

0 40

Scale

N



July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

Exhibit 8

Feasibility Study
Concepts A and B

0 40
Scale

N

overlook

existing trees (typ)

SW
Orchard St
(street end)

proposed loop trail

structural stairs (typ)

gravel trail (typ)

wall (typ)

timber stair A (typ)

July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

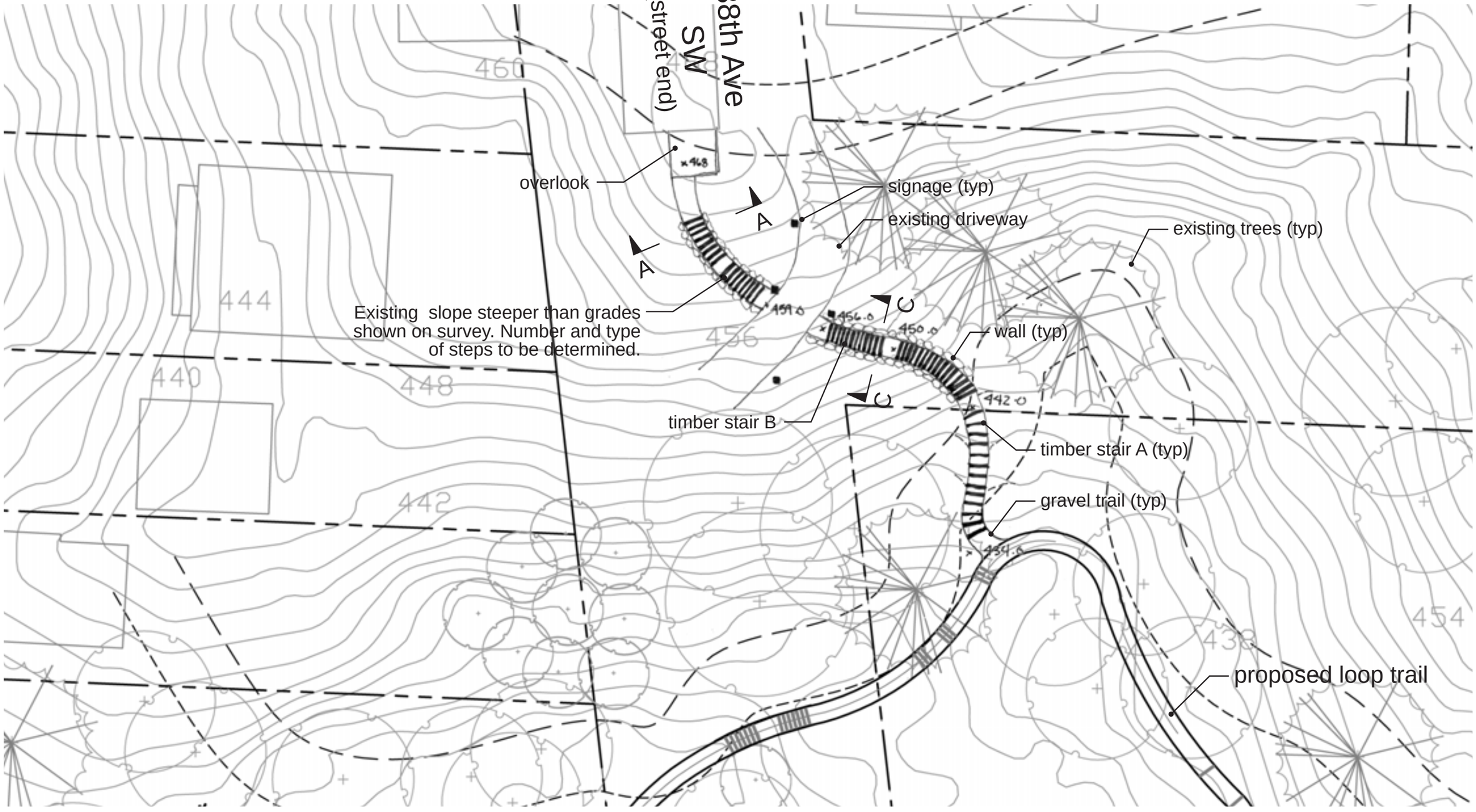
Exhibit 9

Feasibility Study

Concept A

0 20
Scale

N



July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine

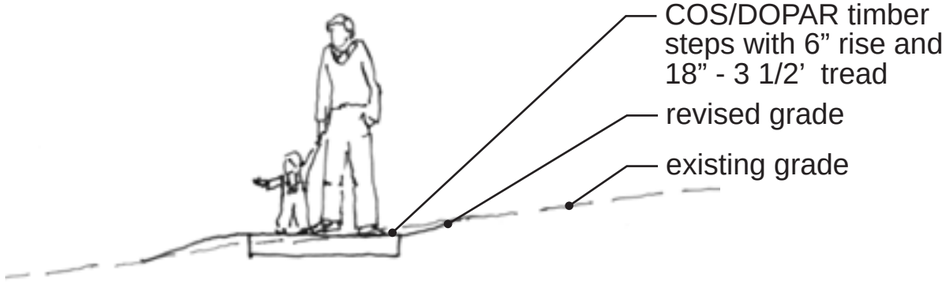
Exhibit 10

Feasibility Study

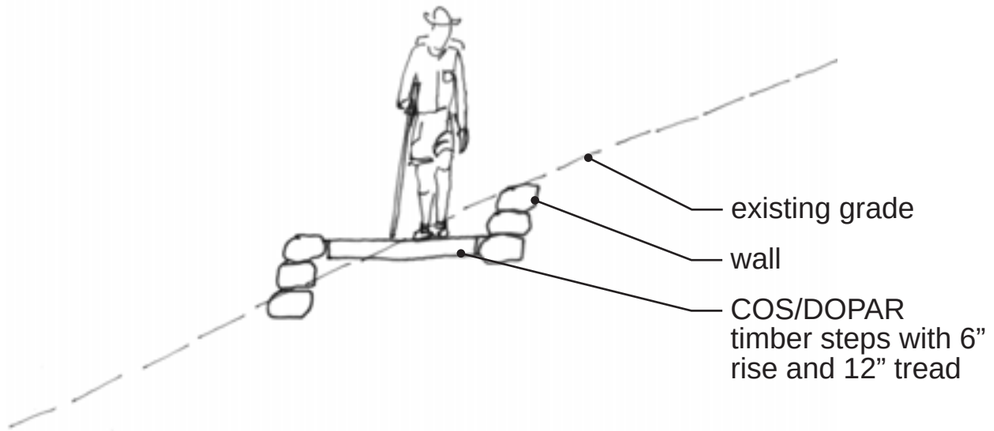
Concept B

0 20
Scale

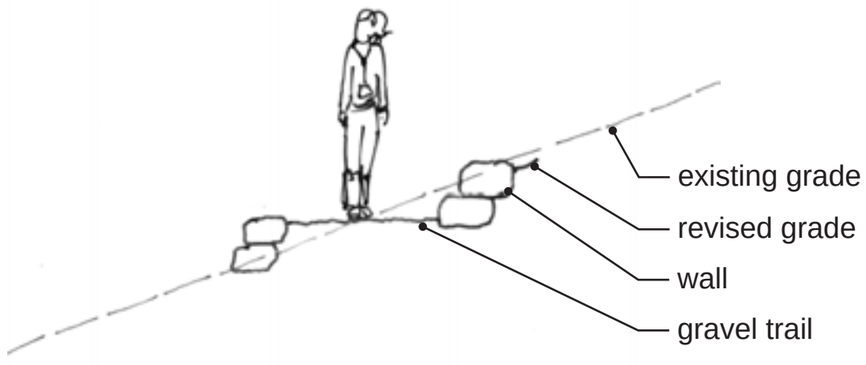
N



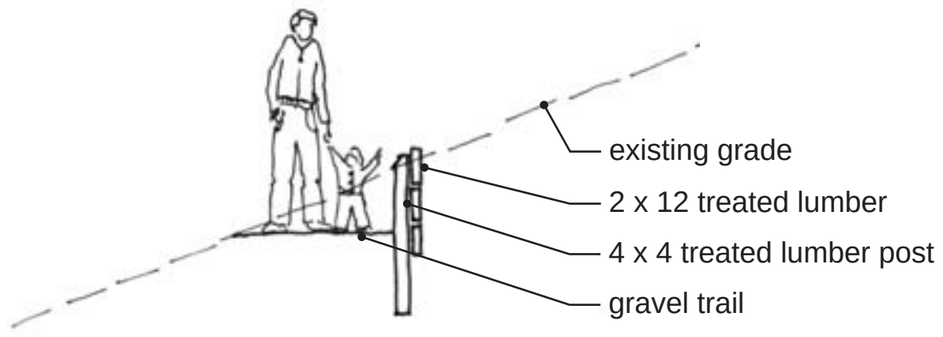
Section AA • Timber Stair A 1/4” = 1’



Section CC • Timber Stair B 1/4” = 1’



Section BB • Gravel Trail with Walls 1/4” = 1’



Section BB alternative • Gravel Trail with Lumber Wall 1/4” = 1’

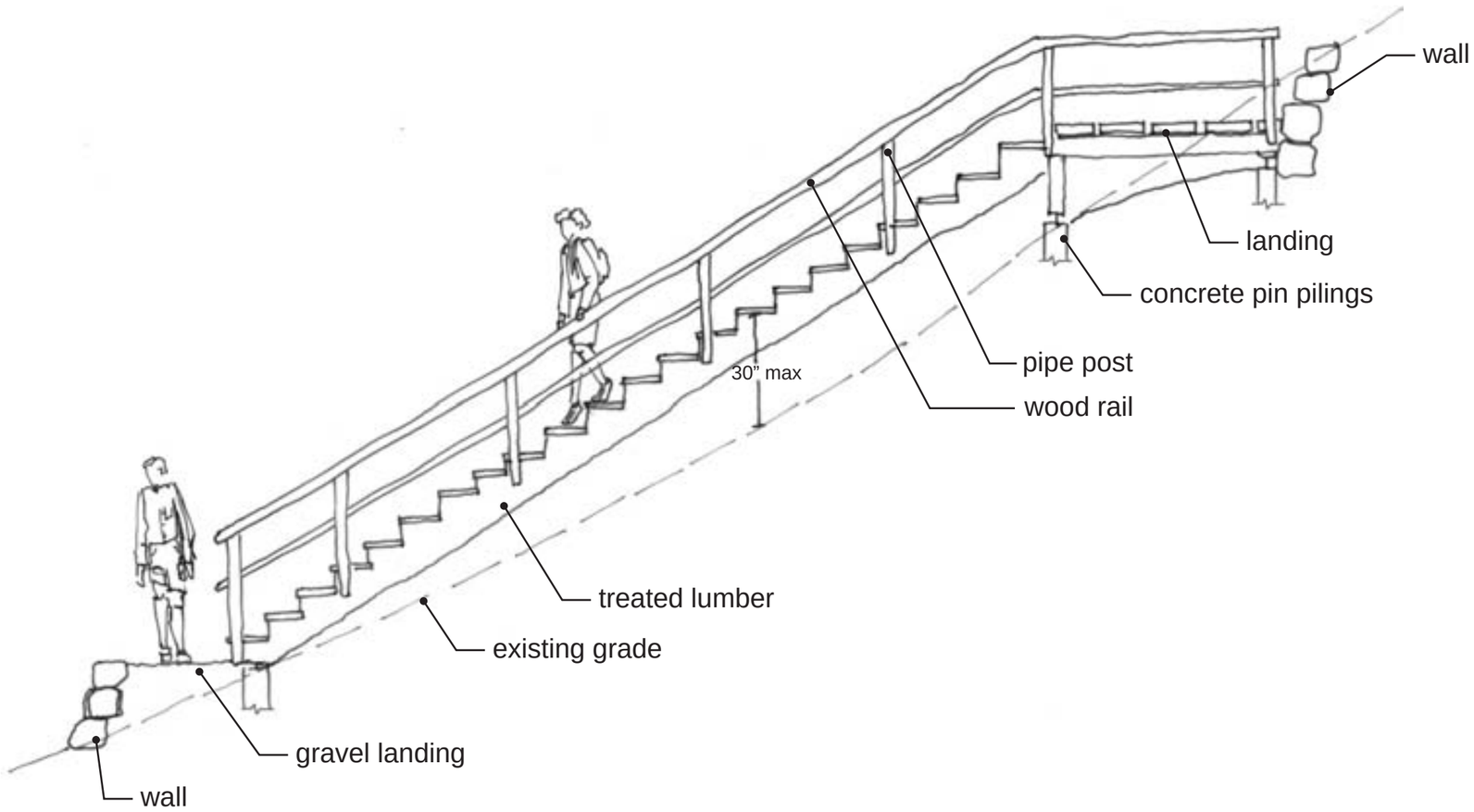
July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

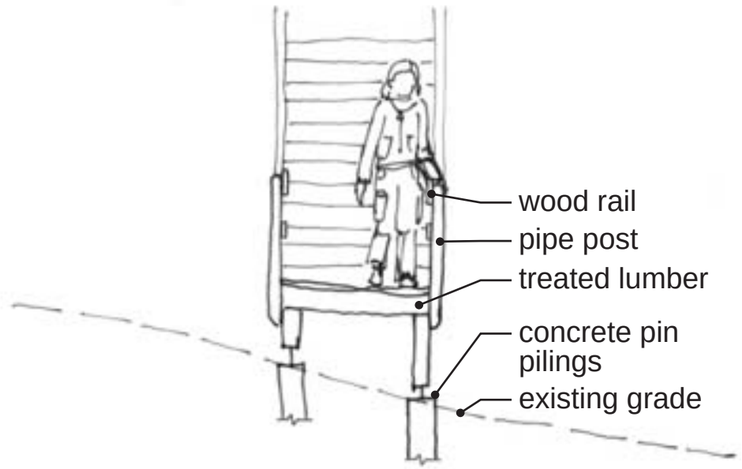
Orchard Street Ravine Exhibit 11

Feasibility Study

Concept Sections



Section DD • Structural Stairs 1/4” = 1’



Section EE • Structural Stairs 1/4” = 1’

July 10, 2006

SvR DESIGN COMPANY
815 Western Ave., Suite 400
Seattle, WA 98104
Phone: 206.223.0326
FAX: 206.223.0125

Orchard Street Ravine Exhibit 12

Feasibility Study

Concept Sections

Orchard Street Ravine

Probable Project Costs for Concept A and Concept B

A

Probable Cost Range

Planning	**$ 4,500**	**$ 5,500**
Design	**$ 52,800**	**$ 60,500**
Survey, Land. Architect, Engineer, Permitting, & Project Mgmt.	$ 48,000	$ 55,000
10% Design Contingency	$ 4,800	$ 5,500
Construction	**$ 186,718**	**$ 232,566**
General Conditions	$ 11,750	$ 14,500
Site Preparation	$ 20,000	$ 25,000
Gravel Pathway	$ 15,000	$ 20,000
Rockery/Retaining Wall	$ 15,000	$ 20,000
Stairways	$ 65,000	$ 75,000
Signage	$ 2,500	$ 5,000
15% Const. Contingency	$ 19,388	$ 23,925
8.8% Sales Tax	$ 13,080	$ 16,141
Inspection	$ 10,000	$ 15,000
Project Management	$ 15,000	$ 18,000
Total Project Costs	**$ 244,018**	**$ 298,566**

B

Probable Cost Range

Planning	**$ 2,500**	**$ 5,000**
Design	**$ 28,600**	**$ 38,500**
Survey, Land. Architect, Engineer, Permitting, & Project Mgmt.	$ 26,000	$ 35,000
10% Design Contingency	$ 2,600	$ 3,500
Construction	**$ 76,123**	**$ 98,203**
General Conditions	4550	5900
Site Preparation	10000	12000
Gravel Pathway	20000	25000
Rockery/Retaining Wall	8500	11000
Stairways	4500	6000
Signage	2500	5000
15% Const. Contingency	$ 7,508	$ 9,735
8.8% Sales Tax	$ 5,065	$ 6,568
Inspection	$ 2,500	$ 4,500
Project Management	$ 11,000	$ 12,500
Total Project Costs	**$ 107,223**	**$ 141,703**